IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Campbell et al.	§	Examiner: Lee, Jong-Suk
	§	
Filed: February 1, 2002	§	Group Art Unit: 3673
	§	
Serial No.: 10/061,861	§	Attorney Docket No.: PM 2000.097
	§	
Title: "Nonstructural Buoyancy Can"	§	Confirmation No.: 2381
	§	

Mail Stop Non-Fee Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF PRIOR INVENTION IN THE UNITED STATES TO OVERCOME CITED PATENT OR PUBLICATION (37 C.F.R. § 1.131)

Before me, the undersigned authority, personally appeared R. Brad Campbell, Mehrdad Mortazavi and Paul Berner, who being by me duly sworn, deposed as follows:

1. R. Brad Campbell, Mehrdad Mortazavi and Paul Berner are employees of ExxonMobil Upstream Research Company, ExxonMobil Development Company, and The Technologies Alliance, Inc. respectively.

PURPOSE OF DECLARATION

2. This declaration is to establish completion of the invention described in this application in the United States at a date prior to November 30, 2000, that is the earliest possible effective date of U.S. Patent No. 6,632,112 (the "'112 reference") that was cited by the Examiner.

3. The persons making this declaration are the inventors.

FACTS AND DOCUMENTARY EVIDENCE

4. To establish the date of completion of the invention described in this application, the inventors disclose a patent memorandum (Exhibit A) as evidence. The patent memorandum is signed by all inventors and witnessed by a non-inventor and is dated prior to November 30, 2000. The date of the patent memorandum has been redacted. The date appearing at the lower portion of the first page of the document "GENERATED 12/7/94" is not the date of the patent memorandum nor in any way related to this particular invention, but only the date this particular form was devised. The patent memorandum provides a written description of our invention which was conceived on a date prior to November 30, 2000.

5. From this document, it can be seen that the invention claimed in Applicants' pending patent application was made prior to the date of November 30, 2000, which is the earliest possible effective date of the '112 reference.

6. Below is a statement establishing the diligence of the Applicants, from a time just prior to the date of the '112 reference, up to the filing of this application.

a) On or about November 11, 2000, one or more of the inventors of the invention embodied in this patent application received from a representative of ExxonMobil Upstream Research Company ("URC") a memorandum requesting an Application Ready Document (ARD) for the invention embodied in this patent application. A copy of the memorandum, dated November 11, 2000 is attached as Exhibit B.

b) From a time after November 11, 2000 until December 18, 2000, one or more of the inventors of the invention embodied in this patent application worked to complete the ARD.

c) On or about December, 18, 2000, one or more of the inventors of the invention embodied in this patent application completed an ARD for the invention embodied in this patent application and transmitted the ARD to one or more representatives of URC. A copy of the ARD, dated December 18, 2000 is attached as Exhibit C. Portions of the ARD have been redacted and such redacted areas are indicated with the word "Redacted".

d) During the time period from a time after December 18, 2000 to February 5, 2001, one or more of the inventors of the invention embodied in this patent application

reviewed one or more draft patent applications for the invention embodied in this patent application and provided comments on such draft patent applications to a representative of URC.

e) On February 5, 2001 a provisional patent application (Ser. No. 60/266,583) for the invention embodied in this patent application was filed with the United States Patent & Trademark Office.

DECLARATION

7. As a person signing below:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: Oct. 4, 2004 R. Brad Campbell

R. Brad Campbell

Date: _____

Mehrdad Mortazavi

Date: 10/5/2004

Paul Berner

STATE OF TEXAS §
§
COUNTY OF HARRIS §

Before me, a notary public, on this day personally appeared **R. Brad Campbell** known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct.

Given under my hand and seal of office this 4 day of October, 2004.

Margaret Gnewuch

MARGARET GNEWUCH
NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES
DEC. 20, 2005

STATE OF TEXAS §
§
COUNTY OF HARRIS §

Before me, a notary public, on this day personally appeared **Mehrdad Mortazavi** known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct.

Given under my hand and seal of office this _____ day of _____, 2004.

_____

STATE OF TEXAS §
§
COUNTY OF HARRIS §

Before me, a notary public, on this day personally appeared **Paul Berner** known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct.

Given under my hand and seal of office this 5 day of Oct., 2004.

Margaret Gnewuch

MARGARET GNEWUCH
NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES
DEC. 20, 2005

REMARKS

Applicants submit this Declaration to remove the '112 patent as a reference and bring the claims into condition for allowance.

If Examiner wishes to discuss this application with counsel, please contact the undersigned.

Respectfully submitted,

Date: Oct 15, 2004

Douglas J. Collins, Reg. No. 43,561
Attorney for applicant

ExxonMobil Upstream Research Company
P.O. Box 2189
Houston, Texas 77252-2189
Telephone: (713) 431-4811
Facsimile: (713) 431-4664

Certificate of Facsimile Transmission

I hereby certify that this correspondence is being transmitted via facsimile to Examiner Jong-Suk Lee, Technology Center 3600, United States Patent and Trademark Office at (703) 872-9306 on _____, 2004.

Margaret Gnewuch

Express Mail Label No. EK 696656255 US

EPR PROPRIETARY

EXXON PRODUCTION RESEARCH COMPANY

PATENT MEMORANDUM

PAT. COMM. OFF

P.M. No. 2000.097

DO NOT FILL IN

TITLE OF INVENTION Nonstructural Buoyancy Can

DESCRIPTION OF INVENTION - Give a full written description (in ink or typewritten) of your invention. Include, or firmly attach, sketches, graphs, photos, data, formulas and any other information which will help others understand the invention. Generally, a memo should minimally contain the following: (1) a statement of the problem, (2) a description of the invention and how it solves the problem and (3) drawings, if possible.

Production risers on deep-draft caisson vessels (DDCV) have to date all been tensioned using steel buoyancy cans attached to the upper end of the riser within the hull's moonpool. The buoyancy can / riser assembly is free to slide along the DDCV longitudinal axis but is constrained by guides in the hull to pitch and surge with the vessel. Since the buoyancy cans transmit reactions between the guides and the riser system they must be designed to act as a structural members. Even though the cans are not exposed to direct wind and wave loading, reactions between the hull and the riser are quite large necessitating a significant amount of additional structural steel in the buoyancy cans. The additional weight requires additional buoyancy (and cost) to counteract it . In addition, because of high static and cyclic stresses going through the connection between the buoyancy can and the riser (or stem pipe) an expensive, heavy forging must be used.

Nonstructural buoyancy cans provide buoyancy without participating in the load transfer between the riser guide and the riser. This is accomplished as shown in the attached figure by providing an external frame that surrounds each buoyancy can. The frame columns are connected to the riser stem pipe by radial arms above and below each can. Each column connects with the column of the cans immediately above and below it making a continuous frame over all of the buoyancy cans. All columns are fabricated from sealed tubular members such that they are neutral or positively buoyant in water. As such, the weight of the structural steel is no longer carried by buoyancy can.

The buoyant force from each can is reacted upwards into the radial arms transferring the force into the riser stem and/or external frame. Lateral loads on the buoyancy cans will be transferred to the columns by bearing. Rings on the outside of the buoyancy can may be used to ensure hydrostatic capacity and improve load transfer to the columns.

This design enables the use of lightweight, flexible, inexpensive materials such as rubber, fiberglass, thin steel, etc for the buoyancy can. The lighter, more flexible, and inexpensive the material, the greater the cost savings. The use of nonmetaic materials further eliminates the need for expensive corrosion protection of the buoyancy can. Preliminary calculations indicate cost savings of $700k per riser for steel can. Even greater cost savings are possible with fiberglass and rubber.

An additional benefit of this invention is the elimination of penetrations in each can for air/nitrogen service lines. Instead the lines are run along side the columns and enter the cans from the opening at the bottom which improves system reliablilty.

(If more space is required, use additional copies of this form. All sheets should be stapled together. EACH SHEET SHOULD BE SIGNED, DATED AND WITNESSED. Forward the completed memo to General Counsel, Exxon Production Research Company, P.O. Box 2189, Houston, Texas 77252-2189.

SIGNATURES

INVENTOR - Sign in the presence of a witness. Print or type full name below signature.

DATE

WITNESS - I have read this document, understand its content, saw the inventor sign his name and have signed on the same date.

1) [signature] Redacted

Paul Berner (The Technologies Alliance)

1) [signature]

Calvin Crossley (URC)

2) [signature] Redacted

Mehrdad Mortazavi (URC)

2)

3) [signature] Redacted

Brad Campbell (URC)

3)

GENERATED 12/7/94

PATMEMO.DOT

1 OF 3

FOIA Redacted

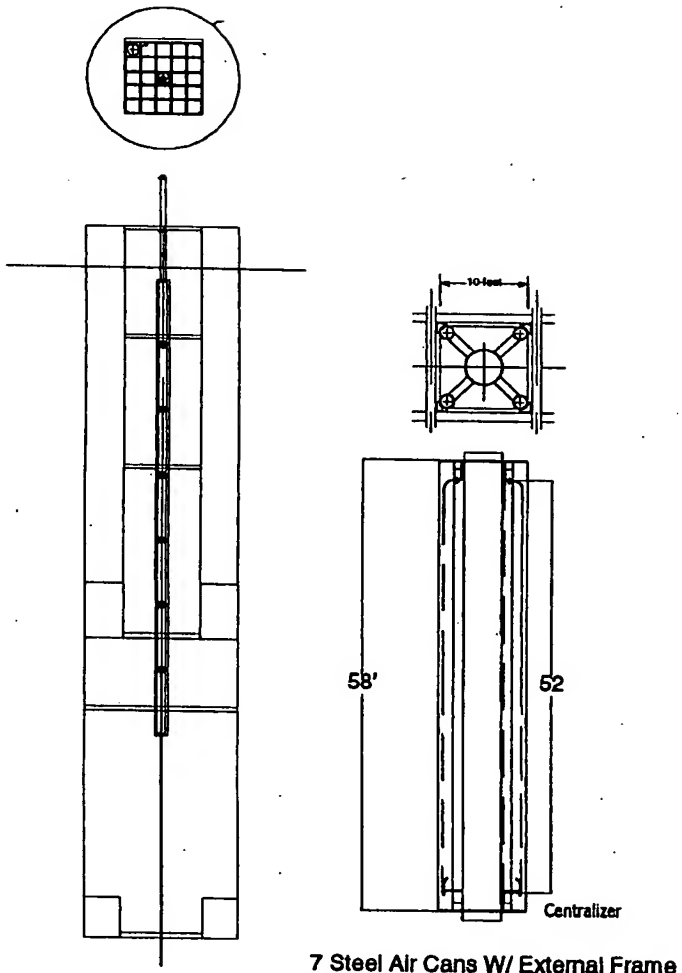
ExxonMobil
Upstream Research

ExxonMobil Proprietary

Alternate Buoyancy Can Designs

External Frame Metal Air Can

2 of 3
Rev Redacted



7 Steel Air Cans W/ External Frame
58-Foot Long
Total Length 406-Feet

Concept Description

- Aircan frame structure is external to aircan shell
- External frame structure provides lateral support along aircan
- Four neutrally buoyant guiding tubes form the corners of external frame
- External radial stiffeners as needed

Potential Impact

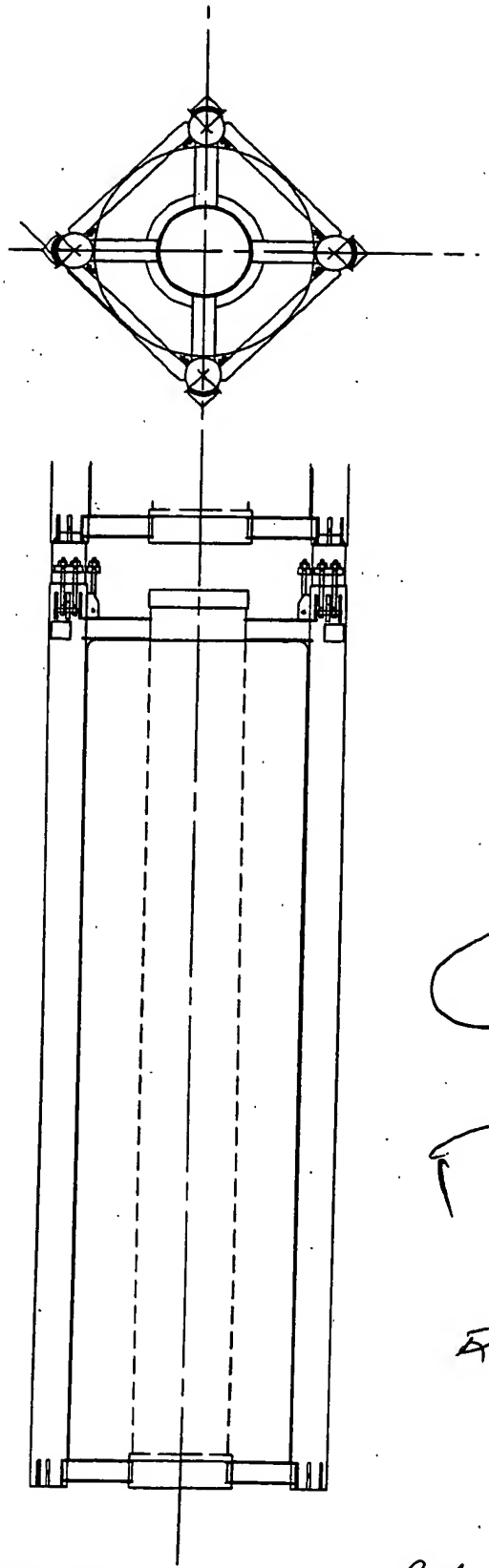
- Reduced weight air-containment shell
- Reduced wet weight
- Increased efficiency
- Improved load transfer
- Simple non-critical hull interface
- Installation flexibility
- Flexibility in guide frame location
- No penetrations in aircans
- Redacted lift
- Total savings per riser = Redacted

Key Challenges / Issues to be Worked

- Design of aircans and external frame
- Design of aircan guide frames

Redacted Redacted Redacted Redacted

Buoyancy Can Concept



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3 of 5
Redacted

ExxonMobil

REQUEST FOR "APPLICATION READY DOCUMENT"

Upstream Research Company

P. M. No.: 2000.097

November 11, 2000

Mehrdad Mortazavi / ST-764 / x7165

Your invention has been approved for the next step in URC's patent application process. You are to prepare an Application-Ready Document (ARD) and Law will prepare broad claims for the invention. The ARD and broad claims will be presented to the Offshore Patent Committee for final review. I have attached a copy of our Application-Ready Document instruction package, which includes an example ARD.

If you desire, I will be happy to discuss the preparation of the ARD with you or to review a preliminary draft of the ARD. If you have any questions, please call me at x4811.

Phillip G. Woo

PGW:mjs

c: J. A. Jennings
R. B. Campbell - ST-846

APPLICATION-READY DOCUMENT (ARD)

EPR's patent application process is initiated when an inventor submits a Patent Memorandum (PM) to the Law Department. As soon as reasonably possible, an initial review meeting will be held by the appropriate Patent Committee (or as delegated by the Patent Committee) to consider the PM. If there is sufficient interest in pursuing patent protection on the invention, the inventor will be requested to prepare an Application-Ready Document (ARD). An ARD is more exhaustive in its discussion of the invention than is a PM. Consequently, an ARD should be prepared only if requested.

An ARD has two primary goals. First, the ARD should provide the Patent Committee with sufficient information to make an informed decision regarding whether or not a patent application should be filed on the invention. Second, if the Patent Committee decides to file an application, the ARD should contain all of the information which the patent attorney will need to prepare the application. Also, since the ARD is more comprehensive than the PM, it should assist the attorney in drafting a stronger, more defensible patent application.

It is generally advisable to have a patentability search performed prior to preparation of the full ARD. The search will be coordinated by the assigned patent attorney who may ask the inventor to prepare a detailed description of the invention (which is a part of the ARD) as an aid to the searcher. Preparation of the other parts of the ARD should be postponed until the inventor and the attorney have reviewed the search results and jointly concluded that the invention is likely to be patentable.

Generally, an ARD should follow the outline shown in Attachment 1 and should be in the form of a memorandum from the inventor to the Patent Committee.

An example of a patent that could result from a well written ARD is attached for your information. Note particularly (1) how **the Background of the Invention** discusses a problem that needs solving and (2) how the **Description of the Preferred Embodiments** discusses the solution to the problem.

Questions regarding preparation of an ARD should be referred to the assigned patent attorney or the division law contact.

To: Offshore Division Patent Committee
From: Brad Campbell / Mehrdad Mortazavi
Date: December 18, 2000

Re: Application Ready Document for PM-2000.097

I. BACKGROUND

A. Area of Technology

This invention relates to the use of buoyancy cans as a means of tensioning risers on floating drilling / production systems.

B. Problem Addressed

A riser used to drill and produce oil and gas with floating facilities can cost many millions of dollars. A substantial portion of that cost is attributable to the system used to keep the riser in tension. This invention provides an alternative design for buoyancy cans that is considerably less expensive and potentially more reliable than the current technology employed.

II. CURRENT TECHNOLOGY

Production risers on deep-draft caisson vessels (DDCV) (a.k.a. spars) have to date all been tensioned using steel buoyancy cans attached to the upper end of the riser within the hull's moonpool. Figure 1 shows the production top tensioned riser (TTR) used for the Diana / Hoover project. The buoyancy can / riser assembly is free to slide along the DDCV longitudinal axis but is constrained by guides in the hull to pitch and surge with the vessel. Since the buoyancy cans transmit reactions between the guides and the riser system they must be designed to act as structural members. Even though the cans are not exposed to direct wind and wave loading, reactions between the hull and the riser are quite large necessitating a significant amount of additional structural steel in the buoyancy cans. The additional weight requires additional buoyancy (and cost) to counteract it. Structural loads acting on the buoyancy cans result in high static and cyclic stresses going through the connection between the buoyancy can and the riser (or stem pipe). The discontinuity in stiffness that occurs between the buoyancy can and stem/riser can further concentrate bending in this area. Both of these effects necessitate the use of expensive and heavy forging to obtain sufficient strength and fatigue performance.

To date, two configurations have been used with buoyancy cans for DDCV risers. The first, known as a non-integral buoyancy can, is shown

in Figure 2. In this configuration, buoyancy cans are attached to a "stem pipe". The smaller diameter production riser is centralized inside (but not rigidly attached to) the stem pipe. The stem pipe and riser are connected together through the tree located at the top of the riser. In this way, the upward force provided by the buoyancy cans is applied directly to the top of the riser. The second configuration, known as an integral buoyancy can, is shown in Figure 3. In this configuration, the buoyancy can is attached directly to the riser. As such, tension is applied to the riser at each buoyancy can location. In addition, each integral buoyancy can affects the local structural characteristics of the riser.

III. DESCRIPTION OF INVENTION

A. Broad Version

Nonstructural buoyancy cans (NBC) provide buoyancy without participating in the load transfer between the riser guide and the riser. This is accomplished as shown in Figure 4 by providing an external frame that surrounds each buoyancy can. The frame columns are connected to the riser stem pipe by radial arms above and below each can. Each column connects with the column of the cans immediately above and below it making a continuous frame over all of the buoyancy cans. All columns are fabricated from sealed tubular members such that they are neutral or positively buoyant in water. As such, the weight of the structural steel is no longer carried by buoyancy can.

The buoyant force from each can is reacted upwards into the radial arms transferring the force into the riser stem and/or external frame. Lateral hydrodynamic loads on the buoyancy cans are transferred to the columns by bearing. Rings on the outside of the buoyancy cans can be used to ensure hydrostatic capacity and improve load transfer to the columns.

This design enables the use of lightweight, flexible, inexpensive materials such as rubber, fiberglass, thin steel, etc for shell of the buoyancy can. The lighter, more flexible, and inexpensive the material, the greater the cost savings. The use of nonmetallic materials further eliminates the need for expensive corrosion protection of the buoyancy can. Preliminary calculations indicate cost savings of [redacted] per riser for steel can. Even greater cost savings are possible with fiberglass and rubber.

An additional benefit of this invention is the elimination of penetrations in each can for air/nitrogen service lines. Instead the lines are run along side the columns and enter the cans from the opening at the bottom, which improves system reliability.

The design shown in Figure 4 portrays a non-integral buoyancy can design. This invention could also be configured as an integral riser buoyancy can. In this application, the external frame could eliminate (or minimize) discontinuity in stiffness and associated problems that occur with conventional designs.

B. Best Mode

Depending on how NBC components are configured, the overall behavior (and cost) of the NBC can be affected. Detailed design has not been performed to date. As such, the "Best Mode" is unknown. Intuition suggests that the external frame should be made stiff, the air can should be flexible and intermediate supports (rings?) will be required at one or more locations between the shell and frame. Factors to be considered are as follows:

1. Configuration of the radial support frame: Variations in the design can affect the distribution of buoyant force between the stem pipe and external frame columns. This in turn will dictate the size / cost of those components.
2. The method of attaching the air can shell to the radial support frame. The shell may be attached to the top and/or bottom radial support frame. As such, the shell may be put in tension or compression.
3. The flexibility of the external frame when subjected to concentrated forces from the hull guides: Ideally the external frame should behave globally as a long stiff beam supported at the hull guides. Local deformation should be limited to the degree possible but this will undoubtedly increase the size / cost of the frame.
4. The lateral connection between the air can shell and the external frame columns: A lateral, oscillatory, distributed force (known as the Froude-Krylov force) acts on the air can shell due to the acceleration of the fluid in the moonpool. If the air can is not in contact with the external columns, the Froude-Krylov (FK) force will be transmitted to the stem pipe by global bending of the air can shell. This will necessitate an expensive shell / stem pipe connection (e.g. forging) to resist fatigue damage. Alternatively, if the shell is in contact with the external columns (continuously or discretely using rings), bending at the shell / stem pipe

connection can be minimized. However, depending on how stiff the external frame is (item 3), local deflections at the hull guide locations could induce bending in the air can shell.

5. Connection between adjacent air can columns / stem pipes: The details of these connections affects the cost, time & effort to install TTRs, and the structural performance of the NBC. For example, the longitudinal connection between external column must carry tension and compression. They may also have to resist moment to ensure compatibility of displacements and/or obtain the desired global behavior. In addition, the connections must not interfere with the sliding of hull guides. Depending on the characteristics of the loads, expensive forging may be required. There are similar considerations for the connection between stem pipes. In addition, it is expected that the stem pipe will be air filled in service. As such, the connection must be pressure tight for the design life of the system.

C. Examples

The configuration shown in Figure 4 is a preliminary engineering design for an NBC that could be used in place of the conventional non-integral buoyancy cans used for the Hoover TTR.

IV. Customer information / business drivers

Redacted

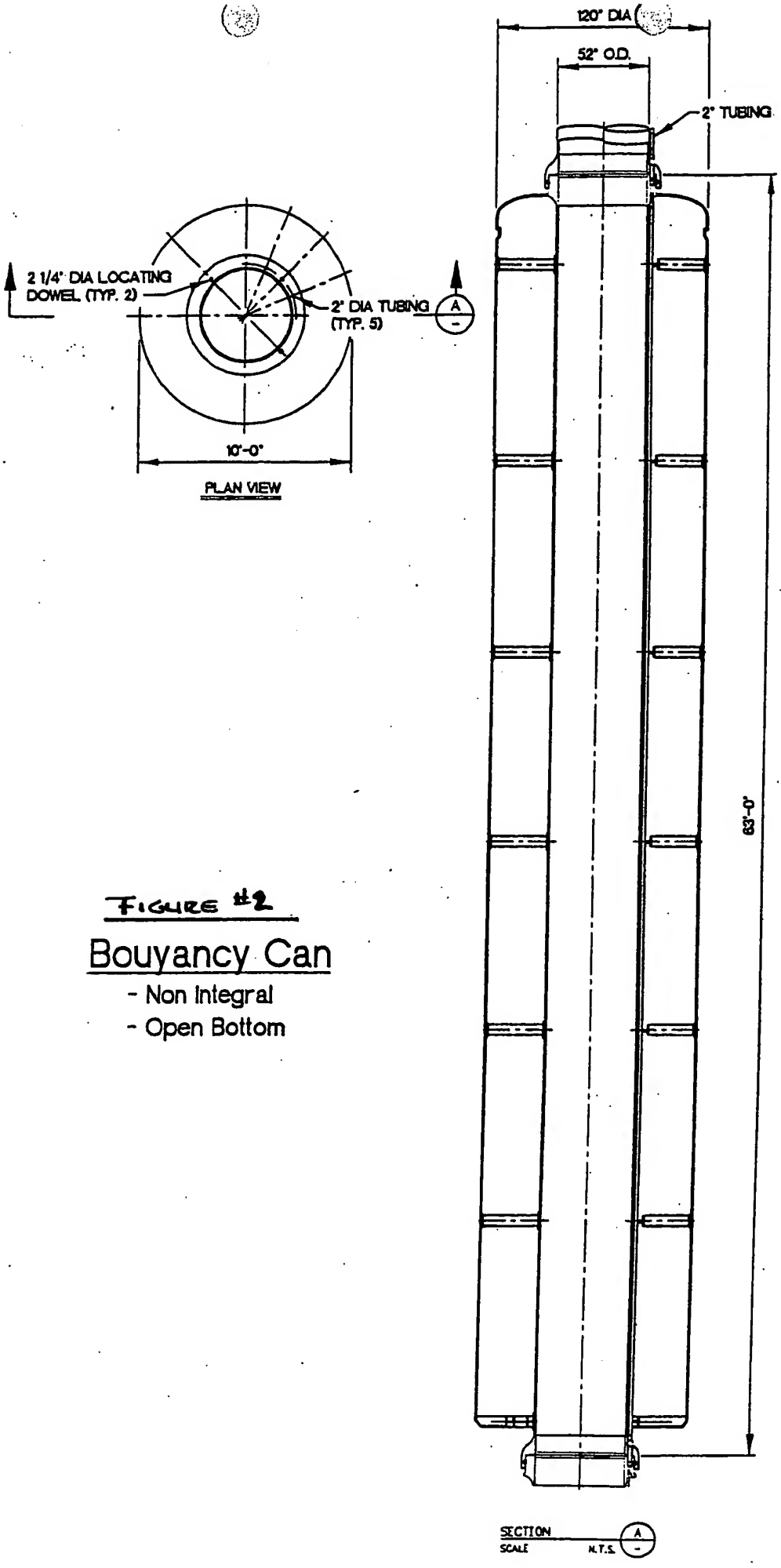
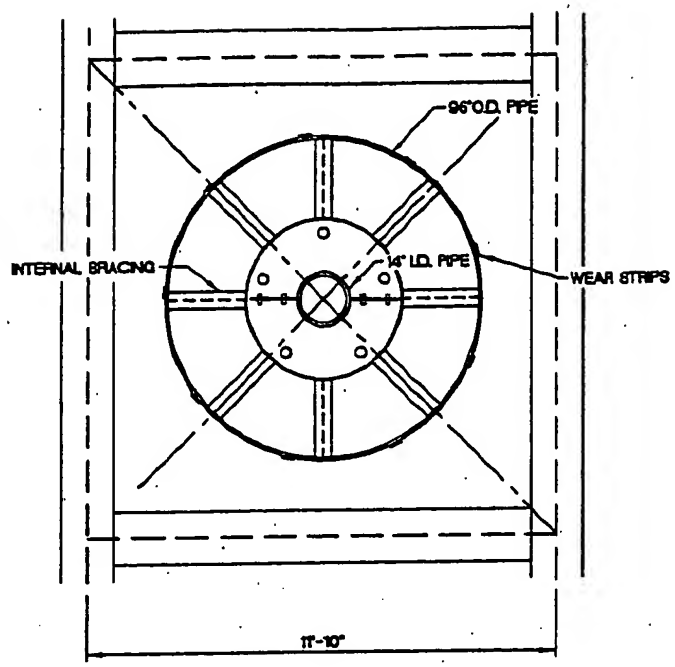


FIGURE #2

Bouyancy Can

- Non Integral
- Open Bottom



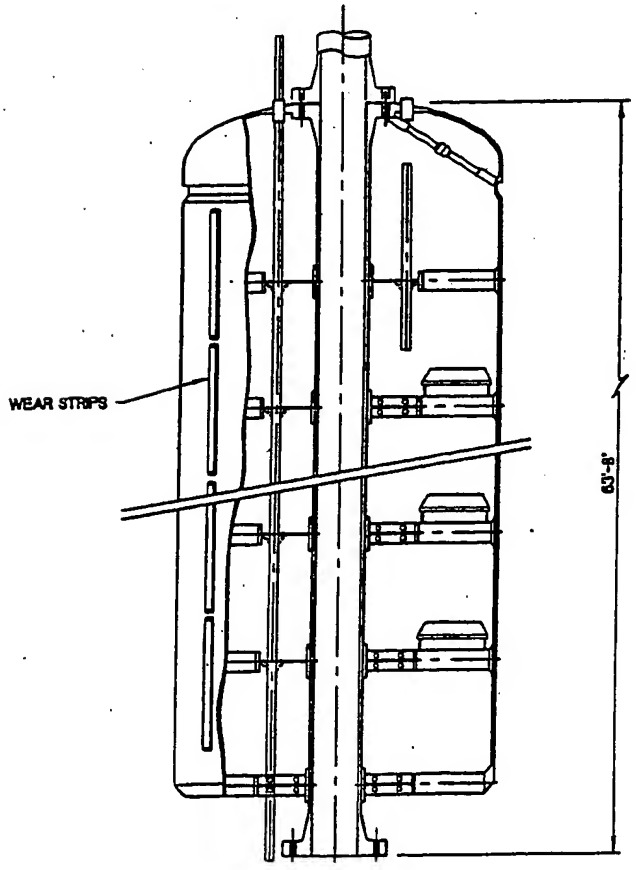
TYP. WELL SLOT PLAN VIEW
GENESIS PROJECT

INTEGRAL OPEN BOTTOM SERIES CANS

FIGURE 3

Bouyancy Can

- Integral
- Open Bottom



ELEVATION

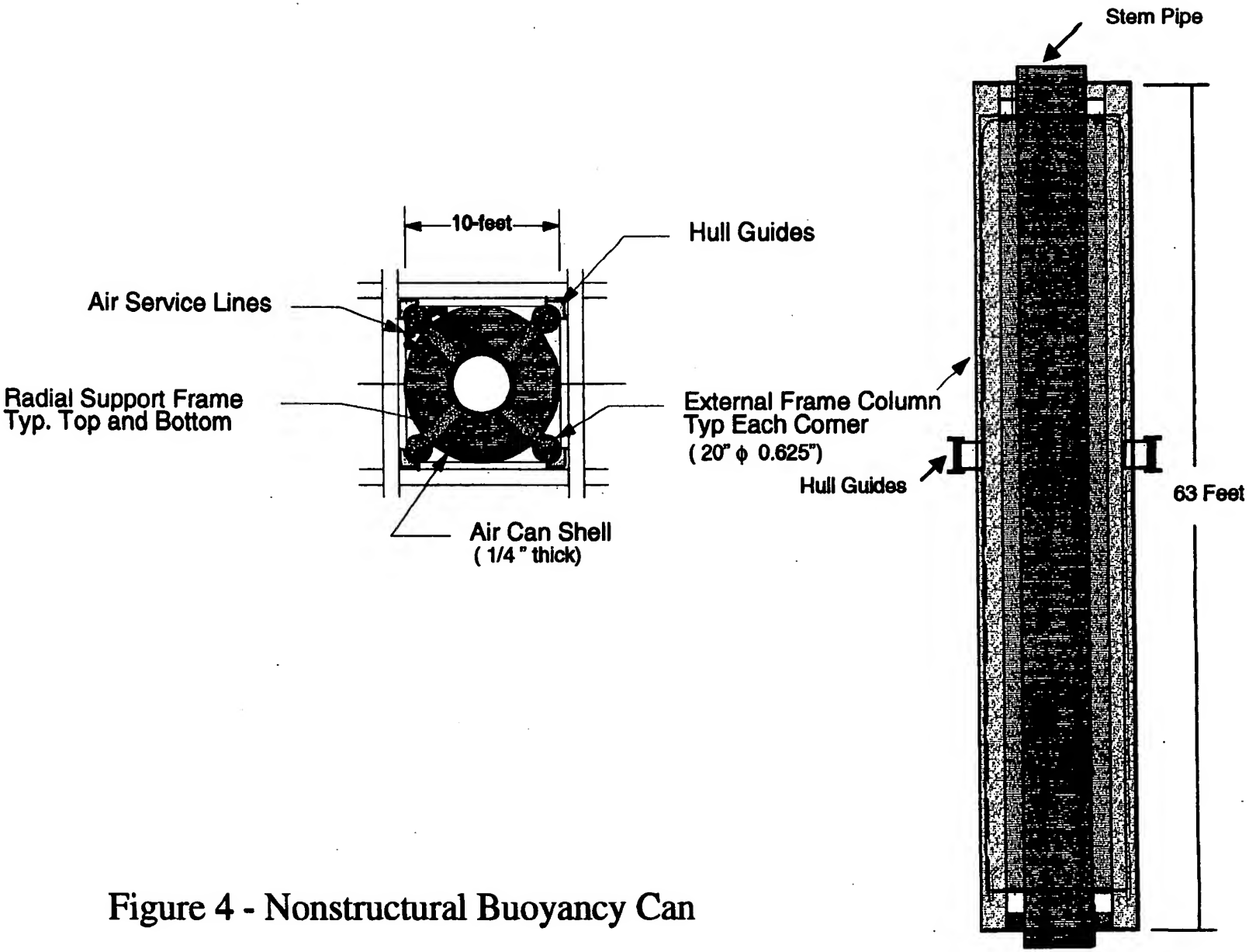


Figure 4 - Nonstructural Buoyancy Can

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Date: OCT. 7, 2004 _____

Date: _____ _____

Date: _____ _____

REPUBLIC OF FRANCE CITY OF PARIS
EMBASSY OF THE UNITED STATES OF AMERICA } SS

Before me, a notary public, on this day personally appeared Mehdad Mostazavi known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct.

Given under my hand and seal of office this 07 day of October, 2004.

Joanna C Melville

Name:_____
Notary Public
US Consulate in Paris, France

Joanna C. Melville
Consular Associate
U.S. Embassy Paris, France

STATE OF TEXAS §
§
COUNTY OF HARRIS §

Before me, a notary public, on this day personally appeared _____ known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct.

Given under my hand and seal of office this _____ day of _____, 2004.

_____
Name:_____
Notary Public, State of Texas

STATE OF TEXAS §
§
COUNTY OF HARRIS §

Before me, a notary public, on this day personally appeared _____ known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct.

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Name:_____
Notary Public, State of Texas

REMARKS

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Respectfully submitted,

Date: Oct 15, 2004

Douglas J. Collins, Reg. No. 43,561
Attorney for applicant

ExxonMobil Upstream Research Company
P.O. Box 2189
Houston, Texas 77252-2189
Telephone: (713) 431-4811
Facsimile: (713) 431-4664

Certificate of Facsimile Transmission

I hereby certify that this correspondence is being transmitted via facsimile to Examiner Jong-Suk Lee, Technology Center 3600, United States Patent and Trademark Office at (703) 872-9306 on _____, 2004.

Margaret Gnewuch

Express Mail Label No. EK 696656225 US